

Control structures: switch

As explained previously, one can use the `if` control structure to conditionally perform a computation. If there are many different conditions to handle, the program quickly becomes complex.

For example, consider the task of writing a function which, for a given month number returns the number of days in this month, or -1 if the month number is invalid. For this we can use the following code:

```
int daysInMonth(int month)
{
    int result;

    if (month == 1)
        result = 31;
    else if (month == 2)
        result = 28;
    else if (month == 3)
        result = 31;
    else if (month == 4)
        result = 30;
    else if (month == 5)
        result = 31;
    else if (month == 6)
        result = 30;
    else if (month == 7)
        result = 31;
    else if (month == 8)
        result = 31;
    else if (month == 9)
        result = 30;
    else if (month == 10)
        result = 31;
    else if (month == 11)
        result = 30;
    else if (month == 12)
        result = 31;
    else
        result = -1;

    return result;
}
```

We can try to “compress” this function using compound tests, as follows:

```
int daysInMonth(int month)
{
    int result;

    if (month == 1 || month == 3 || month == 5
        || month == 7 || month == 8 || month == 10
        || month == 12)
        result = 31;
```

```

else if (month == 4 || month == 6 || month == 9
        || month == 11)
    result = 30;
else if (month == 2)
    result = 28;
else
    result = -1;
}

```

Yet although this code is shorter, it is not particularly more readable.

To simplify this situation, different languages offer different solutions; however they are all based on the same general idea, called a *multi-way branch*:

- at the top, you write only once the variable containing the value to test;
- on subsequent lines, you write the different values that are recognized, and next to this what needs to be done in each case.

The particular multi-way branch construct offered by Java is inherited from the C language; it is called the *switch statement*. It is defined as follows:

Switch statement:

Syntax:

```

switch ( <expression> ) {
    [
        [ case <constant value> : ]*
          [ <statement> ]*
        ]*
    [ default : ]?
      [ <statement> ]*
}

```

(the “switch” keyword, followed by an expression between parentheses, followed by an opening brace, followed by zero or more occurrences of zero or more “case” and zero or more statements, followed by an optional default: followed by zero or more statements, followed by a closing brace).

Semantics: the expression at the top is evaluated. Then the flow of control is transferred to the *case label* that matches the value of the expression; or to the default label if no label matches the expression.

Note

A “case label” is a construct of the form “case <value>”.

For example:

```

int daysInMonth(int month)
{
    switch (month)
    {
        case 1: case 3: case 5:
        case 7: case 8: case 10:
        case 12:
            result = 31;
            break;
        case 4: case 6: case 9:
        case 11:
            result = 30;
            break;
        case 2:
            result = 28;
            break;
        default:
            result = -1;
    }
}

```

This example uses one `switch` with 12 case labels and a default label.

Note how each case uses the “`break`” statement. To understand why, read the “semantics” definition above: control is transferred to the label that matches, but then *the flow of control continues within the `switch` statement, even into the next cases.*

For example with the following code:

```

int n = 3;
switch (n) {
    case 3:
        out.println("three");
    case 5:
        out.println("four");
}

```

this code would print “three” but also “four”: once the flow of control jumps to the case label “case 3”, it continues uninterrupted until the end of the `switch` statement. In order to ensure only the code for “case 3” runs, you need to add `break` as follows:

```

int n = 3;
switch (n) {
    case 3:
        out.println("three");
        break;
    case 5:
        out.println("four");
}

```

Limitations of `switch` in Java

For historical reasons, `switch` in Java can only be used with very few data types in the condition. The full list of types that can be used with `switch` is:

- `int`;
- `String`;

- `byte`, `short`, `char`;
- enumerated types (we will cover this later);
- a few special object classes that wrap around primitive types: `Character`, `Byte`, `Short`, and `Integer`.

In particular, `switch` *cannot match approximate real values* of type `float` or `double`. If you must write a complex condition using values of these types, you are limited to using `if`.

Note

This limitation is a restriction historically inherited from C. Many other programming languages have more comprehensive multi-way branches that can match on many more types. **When learning a new programming language, pay special attention to which multi-way branches it supports.** This is important as it will greatly enhance your productivity when writing your own code.

Important concepts

- *multi-way branching*;
- the *switch statement*;
- *case labels*;
- why `break` is necessary;
- which data types are compatible with `switch`.

Further reading

- Absolute Java, chapter 3 (pp. 107-112)
- Introduction to Programming, section 3.6 (pp. 104-109)

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